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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention is excellent in fire retardancy, thickness uniformity, insulation, tensile strength, and an extension characteristic, and its anisotropy is small and it relates to the sheet made from a polyphenylene ether system resin composition which is excellent in tearing strength.

[0002]

[Description of the Prior Art]Generally, as for polyphenylene ether, it has heat resistance, hot water resistance, dimensional stability, and mechanical and the fault that a moldability is bad since the melt viscosity is high on the other hand although it is resin for which it has the outstanding character, such as electric nature. On the other hand, in order to improve these moldabilities, the moldability had been improved by carrying out the alloy of the polystyrene etc. to polyphenylene ether, but there was a problem that heat resistance fell.

[0003]On the other hand, although polymers, such as polyphenylene ether, are blended with liquid crystal polyester at JP,56-115357,A and improving the melting processability of polyphenylene ether is proposed, It is related with injection molding which requires the high share rate of 100-1000 (1/second), there is no statement about extrusion molding with a low share rate, and it cannot be said that physical properties are also enough. Although the patent No. 3117136 gazette had the statement about the sheet which added the liquid crystal polymer to thermoplastics, real polyester and polycarbonate are made into a matrix and it was not enough in fire retardancy, dielectric strength, etc. although the patent No. 3091105 has a statement about the sheet of polyphenylene ether system resin, it is real **** about styrene system polymer -- it was a thing and was not enough in insulation and anisotropy.

[0004]Blending various kinds of polyallylene oxide with liquid crystal polyester for the purpose of raising solder heat resistance at JP,2-97555,A is proposed, Although blending with JP,6-122762,A the polyphenylene ether which denaturalized by amines, and liquid crystal polyester furthermore was proposed, the description about the moldability of an extrusion-molding sheet did not have all, and they were not enough about physical properties, either. Although the method of improving intensity and rigid recycling holdout to JP,5-86288,A is proposed, there is no description in a sheet and it cannot be said that physical properties are also enough.

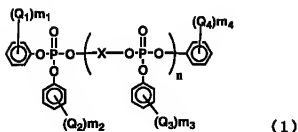
[0005]

[Problem(s) to be Solved by the Invention] This invention is excellent in fire retardancy, thickness uniformity, insulation, tensile strength, and an extension characteristic, its anisotropy is small and an object of this invention is to provide the sheet made from a polyphenylene ether system resin composition which is excellent in tearing strength. [0006]

[Means for Solving the Problem] This invention persons by using as a raw material a resin composition which blended polyphenylene ether system resin, liquid crystal polyester, and fire retardant of a specific amount, and carrying out sheet forming, as a result of examining wholeheartedly art of attaining an aforementioned problem, It excels in fire retardancy, thickness uniformity, insulation, tensile strength, and an extension characteristic, and anisotropy is small, and it finds out that a sheet made from a polyphenylene ether system resin composition which is excellent in tearing strength is obtained, and came to complete this invention.

[0007] Namely, this invention receives resinous principle 100 weight section which consists of the 1.(A) polyphenylene ether system resin 51 - 99.9 weight sections and (B) liquid crystal polyester 0.1 - 49 weight sections, (C) A sheet made from a polyphenylene ether system resin composition obtained from a resin composition which blends 0.1 to fire retardant 30 weight section, 2. Sheet made from polyphenylene ether system resin composition given in one given fire retardant is Lynn system compound, sheet made from polyphenylene ether system resin composition of one statement whose 3. fire retardant is structure of following formula (1), [0008]

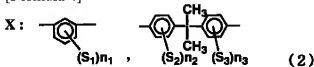
[Formula 3]



(Q₁ in a formula, Q₂, Q₃, and Q₄) The alkyl group or hydrogen of the carbon numbers 1-6 is expressed, n shows one or more integers, m₁, m₂, and m₃, m₄ shows the integer of 0 to 3, and X is chosen from either of the following formulas (2).

[0009]

[Formula 4]



(S₁ in a formula, S₂, and S₃ express a methyl group or hydrogen.) n₁, n₂, and n₃ show the integer of 0 to 2.

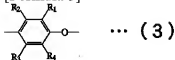
[0010] 4. Sheet made from polyphenylene ether system resin composition given in either of 1-3 whose Elmendorf tearing strength of MD directions is more than 3.0 (N), 5.

Anisotropy ratio AR provides with the sheet made from a polyphenylene ether system resin composition of a statement either of 1-4 which are 0.75 or more.

[0011]

[Embodiment of the Invention] Hereafter, the invention in this application is explained concretely. (A) polyphenylene ether system resin of this invention is the repeating unit structure of a following formula (3). [0012]

[Formula 5]



[0013] (R_1 and R_4 express the low-grade alkyl of hydrogen, the first class, or the second class, phenyl, amino alkyl, or hydrocarbon oxy independently, respectively.) R_2 and R_3 express the low-grade alkyl of hydrogen, the first class, or the second class, or phenyl independently, respectively. from, [become and] Reduced viscosity (0.5 g/dl, chloroform fluid, 30 °C measurement) is the gay polymer and/or copolymer in the range of 0.15 - 1.0 dl/g. still more desirable reduced viscosity -- the range of 0.20 - 0.70 dl/g -- it is the range of 0.40-0.60 most preferably.

[0014] As an example, poly (the 2,6-dimethyl- 1, 4-phenylene ether), Poly (2-methyl-6-ethyl-1,4-phenylene ether), poly (the 2-methyl-6-phenyl- 1, 4-phenylene ether), Poly (the 2,6-dichloro- 1, 4-phenylene ether) etc. are mentioned, A polyphenylene ether copolymer like the copolymer of 2,6-dimethylphenol and other phenols (for example, 2,3,6-trimethyl phenol and 2-methyl-6-butylphenol) is also mentioned. The copolymer of poly (2,6-dimethyl- 1,4-phenylene ether), 2,6-dimethylphenol, and 2,3,6-trimethyl phenol is preferred, and poly (the 2,6-dimethyl- 1, 4-phenylene ether) is still more preferred especially.

[0015] As an example of a manufacturing method of polyphenylene ether, a method of carrying out oxidative polymerization of the 2,6-xlenol is mentioned, using cuprous salt given in a U.S. Pat. No. 3306874 specification, and a complex of amine as a catalyst. A specification of U.S. Pat. No. 3306875, 3257357, and 3257358, A method indicated in each gazette of JP,52-17880,B, JP,50-51197,A, and 63-152628 is also preferred as a manufacturing method of (A) polyphenylene ether.

[0016] Polyphenylene ether system resin may be used with powder after polymerization distance, and may be pelletized and used using an extrusion machine etc. by carrying out melt kneading under a nitrogen gas atmosphere or a non-nitrogen gas atmosphere, devolatilization, or un-devolatilizing. Polyphenylene ether by which (A) polyphenylene ether system resin of this invention was organic-functions-ized with various dienophile compounds is also contained. In a dienophile compound, for example A maleic anhydride, maleic acid, fumaric acid, Compounds, such as phenylmaleimide, itaconic acid, acrylic acid, methacrylic acid, methyl arylate, methyl methacrylate, glycidyl acrylate, glycidyl methacrylate, stearylacrylate, and styrene, are mentioned.

[0017] A method of organic-functions-izing in the state of unmelting, etc. are mentioned under a method of organic-functions-izing according to a molten state under devolatilization or un-devolatilizing under radical generator existence or nonexistence, using an extrusion machine etc. as a method of organic-functions-izing with these dienophile compounds, radical generator existence, or nonexistence.

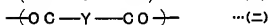
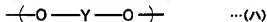
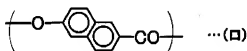
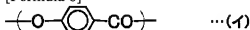
[0018] It is a mixture of polyphenylene ether sole resin or polyphenylene ether resin, and an aromatic vinyl system polymer, and that with which resin of further others was mixed

is also contained in (A) polyphenylene ether system resin of this invention. With an aromatic vinyl system polymer, ATAKU tick polystyrene, syndiotactic polystyrene, high impact polystyrene, an acrylonitrile styrene copolymer, etc. are mentioned, for example. When using a mixture of polyphenylene ether resin and an aromatic vinyl system polymer, as opposed to the total quantity of polyphenylene ether resin and an aromatic vinyl system polymer -- polyphenylene ether resin -- more than 70wt% -- desirable -- more than 80wt% -- it is more than 90wt% still more preferably.

[0019](B) liquid crystal polyester of this invention is polyester called a thermotropic liquid crystal polymer, and can use a publicly known thing. For example, thermotropic liquid crystal polyester which makes para-hydroxybenzoic acid and polyethylene terephthalate a main constitution unit, Thermotropic liquid crystal polyester which makes para-hydroxybenzoic acid and 2-hydroxy-6-naphthoic acid a main constitution unit, Thermotropic liquid crystal polyester etc. which make para-hydroxybenzoic acid, 4,4'-dihydroxybiphenyl, and terephthalic acid a main constitution unit are mentioned, and there is no restriction in particular. As (B) liquid crystal polyester used by this invention, the following structural unit (b), (**), and a thing that consists of (**) and/or (**) if needed are used preferably.

[0020]

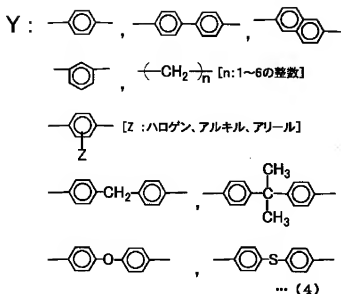
[Formula 6]



[0021] Here, structural unit (b) and (**) are a structural unit of the polyester generated from para-hydroxybenzoic acid, and the structural unit generated from 2-hydroxy-6-naphthoic acid, respectively. The thermoplastic resin composition of this invention excellent in the balance of mechanical properties, such as heat resistance, mobility, and rigidity, excellent in using structural unit (b) and (**) can be obtained. the above-mentioned structural unit (**) and (**) -- inner Y -- the following (formula 4) -- respectively -- arbitrary -- one sort -- or two or more sorts can be chosen.

[0022]

[Formula 7]



[0023]Desirable one in structural-formula (**) Ethylene glycol, hydroquinone, From 4,4'-dihydroxybiphenyl, 2,6-dihydroxynaphthalene, and each bisphenol A, are the generated structural unit and still more desirable one, It is ethylene glycol, 4,4'-dihydroxybiphenyl, and hydroquinone, and especially desirable things are ethylene glycol and 4,4'-dihydroxybiphenyl. In structural-formula (**), the structural unit generated from terephthalic acid, isophthalic acid, and each 2,6-dicarboxynaphthalene is preferred, and terephthalic acid and isophthalic acid are still more preferred.

[0024]Structural-formula (**) and structural-formula (**) can use together at least one sort or two sorts or more for an above mentioned structural unit. In [when specifically using two or more sorts together] structural-formula (**), 1) A structural unit generated from the structural unit/hydroquinone generated from ethylene glycol, 2) A structural unit generated from the structural unit / 4,4'-dihydroxybiphenyl generated from ethylene glycol, a structural unit generated from the structural unit / 4,4'-dihydroxybiphenyl generated from 3 hydroquinone, etc. can be mentioned.

[0025]In structural-formula (**), a structural unit generated from the structural unit/isophthalic acid generated from 1 terephthalic acid, a structural unit generated from the structural unit / 2,6-dicarboxynaphthalene generated from 2 terephthalic acid, etc. can be mentioned. here -- terephthalicity -- the inside of two ingredients -- desirable -- more than 40wt% -- further -- desirable -- more than 60wt% -- it is more than 80wt% especially preferably. By making terephthalicity more than 40wt% among two ingredients, mobility and heat resistance serve as a good resin composition in comparison. Use division in particular of structural unit (b) in a liquid-crystal-polyester (B) ingredient, (**), (**), and (**) is not limited. However, structural unit (**) and (**) serve as an equimolecular amount mostly fundamentally.

[0026]Structural unit (**) which consists of structural unit (**) and (**) can also be used as a structural unit in the (B) ingredient. A structural unit specifically generated from 1 ethylene glycol and terephthalic acid, 2) A structural unit generated from hydroquinone and terephthalic acid, a structural unit generated from 3,4,4'-dihydroxybiphenyl and terephthalic acid, 4) A structural unit generated from 4,4'-dihydroxybiphenyl and isophthalic acid, a structural unit generated from 5 bisphenol A and terephthalic acid, etc.

can be mentioned.

[0027]

[Formula 8]



[0028]The structural unit generated from other aromatic dicarboxylic acid, aromaticdiol, and aromatic hydroxycarboxylic acid can be introduced into (B) liquid-crystal-polyester ingredient of this invention in a little ranges of the grade which does not spoil the feature and effect of this invention if needed. 150-350 °C of temperature (henceforth liquid crystal starting temperature) which begins to show the liquid crystal state in the time of melting of the (B) ingredient of this invention is 180-320 °C still more preferably. The dielectric dissipation factor ($\tan\delta$) at 25 °C of a liquid-crystal-polyester ingredient and 1 MHz is 0.03 or less preferably, and is 0.025 or less still more preferably. As the value of this dielectric dissipation factor is small, the electrical noise to generate is controlled and dielectric loss is more preferred, when becoming small and using this resin composition as a raw material of an electric electronic component. A dielectric dissipation factor ($\tan\delta$) is 0.03 or less preferably, and is 0.025 or less still more preferably especially in the bottom of 25 °C and a high frequency range, i.e., a 1-10-GHz field.

[0029]Melt viscosity (it is 100/second of shear rate at liquid crystal starting temperature of +30 °C) of appearance of (B) liquid-crystal-polyester ingredient of this invention is 10 - 1,000 Pa-s especially preferably ten to 2,000 Pa-s still more preferably ten to 3,000 Pa-s preferably. Making apparent melt viscosity into this range makes mobility of a constituent obtained desirable.

[0030](A) Loadings of polyphenylene ether system resin are 51 to 99.9 weight section, are 60 to 99 weight section preferably, and are 70 to 98 weight section still more preferably. If there are more these loadings than 99.9 weight sections, mobility will fall greatly, it will become easy to generate ***** in a T-die part, and a fall of molding stability will be caused. If there are few these loadings than 51 weight sections, aggravation of thickness unevenness of a sheet will be caused or reduction of anisotropy will become difficult. Here, ***** are things, such as decomposition oligomer, a bridge construction thing of resin, etc. which deposit as foreign matters at least in a direct near part where melting resin is breathed out among T dies the time of extrusion molding. This *** -- being alike -- it has an adverse effect on production stability by sometimes adhering to a sheet.

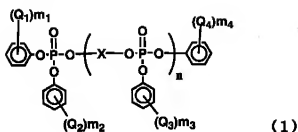
[0031](B) Loadings of liquid crystal polyester of an ingredient are 0.1 to 49 weight section, are one to 40 weight section preferably, and are two to 30 weight section still more preferably. If there are more these loadings than 49 weight sections, the anisotropy of a liquid crystal polymer becomes high, and thickness unevenness of a sheet will become large and will cause a fall of tearing strength. If there are few these loadings than 0.5 weight sections, mobility will fall greatly -- *** -- it is alike, and generating must be caused, or discharge quantity must be made small on a relation of load of an extruding press machine, and there are problems, such as a fall of productivity.

[0032]As (C) fire retardant of this invention, publicly known fire retardant used for thermoplastics can be used. As organic system fire retardant, a phosphoric ester compound, a phosphorous ester compound, Phosphazene compound, straight-chain-shape

silicone compound, rudder type silicone compound, and basket-like silsesquioxane etc. are mentioned, and magnesium hydroxide, aluminium hydroxide, etc. which have red phosphorus and crystal water as an inorganic flame retardant are mentioned. [0033] In these, a viewpoint to red phosphorus or an organophosphorus compound of a fire-resistant level and environment is preferred. A viewpoint of furthermore making small anisotropy in MD (flow direction of melting resin) and TD (MD and rectangular directions) of a sheet to an organophosphorus compound, especially a phosphoric ester compound are preferred. As a phosphoric ester compound, although mono-organophosphorus compounds and organophosphorus compound oligomer, such as triphenyl phosphate and tricresyl phosphate, are mentioned, especially organophosphorus compound oligomer is preferred. What is chosen from a compound group expressed with a following formula (1) as an especially desirable example of organophosphorus compound oligomer can be mentioned.

[0034]

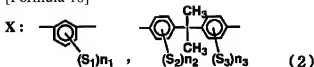
[Formula 9]



(Q₁ in a formula, Q₂, Q₃, and Q₄) An alkyl group or hydrogen of the carbon numbers 1-6 is expressed, n shows one or more integers, m₁, m₂, and m₃, m₄ shows an integer of 0 to 3, and X is chosen from either of the following formulas (2).

[0035]

[Formula 10]



(S₁ in a formula, S₂, and S₃ express a methyl group or hydrogen.) n₁, n₂, and n₃ show the integer of 0 to 2.

[0036] The loadings of fire retardant are 0.1 - 30 weight section to resinous principle 100 weight section which consists of a (A) ingredient and a (B) ingredient, are 0.5 - 15 weight section preferably, and are 2 - 5 weight section preferably [it is still more desirable and] to 1 - 10 weight section, especially a pan. If there are few loadings of this fire retardant than 0.1 weight sections, sufficient fire retardancy of a sheet is not acquired, and anisotropy will become large and sufficient Elmendorff tearing strength will not be obtained. If there are more these loadings than 30 weight sections, the melt viscosity of a resin composition will fall and the moldability of a sheet will fall.

[0037] In this invention, in the range which does not spoil the above-mentioned feature and an effect of this invention other than an ingredient, if needed Other addition ingredients, For example, an antioxidant, an elastomer, plasticizers, such as oil, low

molecular weight polyethylene, epoxidized soybean oil, a polyethylene glycol, and fatty acid ester, a fire-resistant auxiliary agent, a weatherability (light) nature improving agent, a nucleating agent for polyolefines, a slipping agent, various colorant, a release agent, etc. may be added. A resin composition of this invention can be manufactured by various methods. For example, although a heat melting kneading method by single screw extruder, twin screw extruder, roll, a kneader, the Brabender plastograph, a Banbury mixer, etc. is mentioned, a melt kneading method which used a twin screw extruder especially is the most preferred. Especially melt kneading temperature in this case can usually be arbitrarily chosen out of 150-350 **, although not limited.

[0038] Thickness is 0.010-1.0 mm, a sheet of this invention is 0.050-0.50 mm preferably, and it may be called a film depending on the case. A sheet of this invention uses as a raw material a resin composition obtained above, and is obtained by extrusion sheet forming. T-die extrusion molding and inflation molding are preferred, and T-die extrusion molding is still more preferred from a viewpoint of a heat shrinkage rate and thickness unevenness. It may use with no extending, 1 axis extension may be carried out, and it is obtained also by carrying out biaxial extension. It may extend one by one and simultaneous extension may be carried out.

[0039] As for a manufacturing method of a sheet of this invention, it is preferred to choose skin temperature of a reduction roll just behind a T die of an extruding press machine from within the limits of 120-200 **. This skin temperature is 130-180 ** still more preferably, and is 150-170 ** still more preferably. As for preset temperature, it is preferred that Bure's ** is small, and less than **10 ** of the **** [less than **5 ** of] is less than **2 ** still more preferably. As this **** is small, it is more preferred from a viewpoint of thickness unevenness and molding stability.

[0040] The <Elmendorff tearing strength> sheet so that each piece may become parallel at MD (flow direction) and TD (they are rectangular directions to MD), It cuts into a size of 150 mm x 150 mm, is made a two-sheet pile, and is obtained by measuring tearing strength of MD directions based on the JISK7128B method. When it is desirable that it is more than 3.0 (N) as for the Elmendorff tearing strength of MD and this value is smaller than 3.0 (N), it may interfere with practical strength as a sheet.

[0041] <anisotropy ratio AR> $AR = TS(TD) / TS(MD)$

TS(TD): As for tensile strength anisotropy ratio AR of MD directions in tensile strength TS(MD): 23 ** of a TD direction in 23 **, it is desirable that it is 0.75 or more. Still more preferably, it is 0.80 or more and is 0.90 or more still more preferably especially. In this invention, fire retardancy, thickness uniformity, electrical breakdown strength, tearing strength, and an extension characteristic of a sheet can be raised by leaps and bounds by blending the (C) ingredient of a specific amount to the (A) ingredient and the (B) ingredient so that this anisotropy AR may be made or more into 0.75. In order to carry out orientation of the (B) liquid crystal polyester of this invention to MD, TS (TD) means that it is common to be smaller than TS (MD), and anisotropy is smaller as a value of anisotropy ratio AR of this invention has come in size.

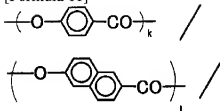
[0042] A sheet of this invention is excellent in fire retardancy, thickness uniformity, insulation, tensile strength, and an extension characteristic, and its anisotropy is small and it is excellent in tearing strength. Therefore, it can use for a use of the following as which these characteristics are required. An insulated component etc. which are called a mechanism element in a product relevant to a household appliance and OA which are

represented by a personal computer, a cellular phone, a refrigerator, a facsimile, copying machine, etc., a printed circuit board, or an insulating washer of a lithium ion battery are mentioned.

[0043] Hereafter, this invention is explained based on an example. However, this invention is not limited to the following examples, unless the main point is exceeded. Ingredient polyphenylene ether PPE-1 used in the example \therefore Powder-like polyphenylene ether PPE-2 of reduced viscosity 0.42; Mallein-ized polyphenylene ether produced by making powder-like polyphenylene ether and a maleic anhydride of reduced viscosity 0.44 react by a method of JP,2000-191769, A example 1 statement [0044] Liquid-crystal polyester LCP-1: Liquid crystal polyester which has the following theoretical structure types was obtained by preparing and carrying out heat melting of para-hydroxybenzoic acid, 2-hydroxy-6-naphthoic acid, and the acetic anhydride, and carrying out a polycondensation under a nitrogen atmosphere. An ingredient ratio of a presentation expresses a mole ratio.

[0045]

[Formula 11]

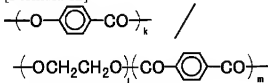


$$k/l = 0.73/0.27$$

[0046] LCP-2: The liquid crystal polyester which has the following theoretical structure types was obtained by preparing and carrying out heat melting of para-hydroxybenzoic acid, polyethylene terephthalate, and the acetic anhydride, and carrying out a polycondensation under a nitrogen atmosphere. The ingredient ratio of a presentation expresses a mole ratio.

[0047]

[Formula 12]



$$k/l/m = 0.82/0.18/0.18$$

[0048] Physical-properties evaluation was carried out in accordance with the following methods with the sheet forming of each resin composition.

(1) A single screw extruder with a screw diameter of 65 mm which set the sheet forming profitable **** pellet as the cylinder temperature of 300 ** and T die temperature of 300 ** is used, Extrusion sheet forming was carried out under 0.5 mm of die clearance, 0.25-0.30 mm of rolling roller clearance, and the conditions of rolling roller skin temperature [of 130 **] ** by 4.2-4.8-m/in discharge quantity 60 kg/hr and taking over speed.

[0049] (2) A sheet obtained under conditions of the fire-resistant above (1) so that each piece may become parallel at MD (flow direction) and TD (they are rectangular

directions to MD), It cut off in size with a 200 mm[in length] x width of 50 mm, and a burning test was carried out based on a UL-94 film standard of Underwriters Laboratories.

UL film standard VTM-0: There is no dropping and a sum total burning time is a thing for 50 or less seconds.

VTM-1: There is no dropping and a sum total burning time is a thing for 250 or less seconds.

[0050](3) Thickness unevenness (Dt)

A sheet obtained above (1) was cut into a size of 150 mm x 150 mm so that each piece might become parallel at MD (flow direction) and TD (they are rectangular directions to a flow direction), a thickness of nine places was measured using a micro gauge, and it asked according to the following formulas.

The greatest thing among $Dt(\%) = (T_{\max} - T_{\text{av}}) / T_{\text{av}} \times 100$ T_{\max} : 9 place thickness.

T_{av} : Average value of 9 place thickness.

[0051](4) A sheet obtained by the dielectric strength above (1) was cut into 100 mm x 100 mm, and it measured using a withstand voltage test machine (SD-12 type, the Toshiba Corp. make) based on JISK6911. A measurement temperature atmosphere is 23 **.

[0052](5) The Elmendorff tearing strength sheet was cut into a size of 150 mm x 150 mm so that each piece might become parallel at MD (flow direction) and TD (they are rectangular directions to MD), and it was made a two-sheet pile, and tearing strength of MD directions was measured based on the JISK7128 B method.

[0053](6) A tractive-characteristics autograph (AG-5000, Shimadzu [Corp.] Corp. make) is used, A sheet obtained above (1) was cut off in the shape of [6 mm-wide] *****, it examined by having pulled by distance between zippers of 80 mm, and test period 50 mm/min, and tensile strength (TS) and elongation after fracture (E) were measured. the length direction of a specimen carried out TDs measurement of each with MD. A temperature atmosphere of measurement was carried out in 23 **.

[0054](7) A following formula defined anisotropy ratio AR anisotropy ratio AR.

$AR = TS(TD) / TS(MD)$

tensile strength of MD directions in tensile strength TS(MD):23 ** of a TD direction in TS(TD):23 ** -- here, a value measured by a method of the above (6) was used for TS (TD) and TS (MD).

[0055]

[Example 1] Polyphenylene ether (PPE-1), liquid crystal polyester (LCP-1), and phosphoric ester fire retardant (it may omit CR-741, the Daihachi chemicals company make, and the following "P-1") at a rate (weight section) shown in Table 1. Melt kneading was carried out using a twin screw extruder with a vent port (made by ZSK-25; WERNER&PFLEIDERER) set as 250-300 **, and it obtained as a pellet. Sheet forming processing was carried out by a method shown above using this pellet. Average thickness of a sheet was 0.32 mm. Physical-properties evaluation was carried out in accordance with a method which showed these sheets above. The result was shown in Table 1.

[0056]

[Example 2] Except making liquid crystal polyester (LCP-1 and LCP-2) into the rate (weight section) shown in Table 1, melt kneading was carried out like Example 1, and the

pellet was obtained. Sheet forming processing was carried out by the method shown above using this pellet. The average thickness of the sheet was 0.31 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0057]

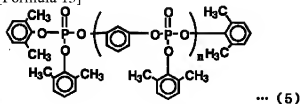
[Example 3] It may abbreviate to polyphenylene ether (PPE-2) and phosphoric ester fire retardant (CR-747, the Daihachi chemicals company make, henceforth, "P-2"). Except using and blending with the rate shown in Table 1, melt kneading was carried out like Example 1, and the pellet was obtained. Sheet forming processing was carried out by the method shown above using this pellet. The average thickness of the sheet was 0.33 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0058]

[Example 4] Except using the phosphoric ester compound (it may omit the mixture of n=1-3, and the following "P-3".) which has structure of the following formulas (5) as fire retardant, melt kneading was carried out like Example 1, and the pellet was obtained. Sheet forming processing was carried out by the method shown above using this pellet. The average thickness of the sheet was 0.32 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0059]

[Formula 13]



[0060]

[Example 5] As polyphenylene ether system resin, polyphenylene ether (PPE-1) and high impact polystyrene (it may omit H9405, the product made by A&M, and the following "HIPS".) are used, Except blending with the rate shown in Table 1, melt kneading was carried out like Example 1, and the pellet was obtained. Sheet forming processing was carried out by the method shown above using this pellet. The average thickness of the sheet was 0.32 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0061]

[Example 6] Except using triphenyl phosphate (it may omit TPP, the Daihachi chemicals company make, and the following "P-4".) instead of P-1 as fire retardant, melt kneading was carried out like Example 2, and the pellet was obtained. Sheet forming processing was carried out by the method shown above using this pellet. The average thickness of the sheet was 0.34 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0062]

[Comparative example 1] Except not having used fire retardant, after carrying out melt kneading like Example 1 and obtaining a pellet, sheet forming processing was carried

out. The average thickness of the sheet was 0.38 mm. Physical-properties evaluation was carried out in accordance with the method which showed these sheets above. The result was shown in Table 1.

[0063]

[Comparative example 2] Except having used polyphenylene ether (PPE-1) 100 weight section as the raw material, it was the same method as Example 1, and melt kneading was carried out and the pellet was obtained. By the method shown above using this pellet, although sheet forming processing was tried, since the torque load of the extruding press machine was excessive, sheet forming was not made on the conditions.

[0064]

[Table 1]

			実施例1	実施例2	実施例3	実施例4	実施例5	実施例6	比較例1		
組成	(A)	PPE-1	95	93		95	93	93	95		
		PPE-2			97						
		HIPS					5				
	(B)	LCP-1	5	5	3	5	2	5	5		
		LCP-2		2				2			
	(C)	P-1	3	5			7				
		P-2			2						
P-3					3						
P-4							5				
物理特性	耐熱性	MD	最大膨張時間(秒)	9	8	7	8	6	8	15	
			合計膨張時間(秒)	48	39	45	42	40	41	59	
		TD	ULフィルム規格	VTM-0	VTM-0	VTM-0	VTM-0	VTM-0	VTM-0	VTM-1	
			最大膨張時間(秒)	5	5	6	6	5	5	11	
	厚みむら	Dt	(%)	0.16	0.21	0.13	0.17	0.18	0.29	0.80	
			絶縁破壊強さ	(kV/mm)	67.0	73.2	75.1	68.2	69.1	68.5	60.3
		エルゴンドルフ引き裂き強度(N)		3.19	3.61	3.91	3.22	3.82	3.12	1.95	
			引張特性	MD	TS(MPa)	75	79	78	76	84	78
	E(%)				20	24	23	28	24	22	16
	TD			TS(MPa)	73	70	65	72	65	68	58
		E(%)		9.3	8.9	12.1	14.5	13.0	12.8	2.4	
	異方性比	AR		0.97	0.89	0.83	0.95	0.77	0.89	0.74	

[0065]

[Effect of the Invention]It excelled in fire retardancy, thickness uniformity, insulation, tensile strength, and an extension characteristic, and anisotropy was small and this invention enabled it to provide the sheet made from a polyphenylene ether system resin composition which is excellent in tearing strength.

[Translation done.]